Fact Sheet

COLD REGIONS WATER RESOURCES PROGRAM

PROBLEM

The prediction of the quantity and timing of runoff, water quality, sedimentation, and river morphological response during winter and spring is important to the Corps of Engineers in managing the nation's water resources, particularly the levels and flow in Corps flood control reservoirs and along major rivers in the United States. Deficiencies exist in being able to economically and efficiently analyze, simulate, and predict the timing and peak flow for 1) snowmelt runoff for flood forecasting for rivers and reservoirs, 2) winter low flow yields, 3) runoff and sedimentation from partly glacierized and permafrost basins in Alaska, 4) bank erosion impacts on fisheries and aquatic habitats, and 5) winter water quality beneath river and lake ice covers.

SOLUTION

The Cold Regions Water Resources Program considers those aspects of winter conditions including snow, ice, frozen ground, and freeze–thaw cycles on the hydrologic cycle, water quality, and hydraulic design of water control projects. Specific objectives include modification of the NEXGEN runoff models to more accurately predict snowmelt by focusing on distributed modeling techniques for runoff, defining and evaluating winter low flow characteristics in basins, evaluating GIS modeling tools to predict the effects of partial glacierization and permafrost on basin runoff for the Chena River Basin in Alaska, and providing new guidance in the form of an Engineering Manual (EM) on the use of environmental isotopes for hydrologic and hydraulic studies.

RESULTS

An updated EM on runoff from snowmelt has been prepared. A state-of-the-art report, CRREL Monograph 93-2, Glaciohydrologic and Glaciohydraulic Effects on Runoff and Sediment Yield in Glacierized Basins (Dr. Daniel E. Lawson, author), was completed. Research results in various topics of cold regions water resources have been published in scientific journals, conference proceedings, in-house reports, and book chapters. Research investigations in cooperation with the USGS (WEBB program) in the Sleepers River Watershed have continued with emphasis on improving the prediction of snowmelt runoff. Research focuses on measuring the timing and amount of snowmelt from installed lysimeters, snowcover depletion as a function of vegetative and terrain features, and hydrograph analysis using environmental isotopes to separate surface and groundwater components during snowmelt. Results to date indicate that the ground-water contribution is very high during snowmelt, ranging from 70–50% of the total spring runoff (depending on basin size). Revising model algorithms to properly route the flow into surface and subsurface regimes is beginning, as unit hydrograph methods are deficient.

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